

TECHNICAL REPORT

NASA CR-

Evaluation of Anomalies Observed
on Film from S-190A
Flight System Calibration Test

141604

Prepared Under

Contract NAS 9-11500
Task Order HT- 65

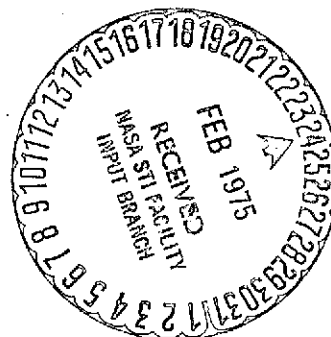
Prepared By

Paul F. Bourque
Lincoln Perry
Gerard E. Sauer

January 1973

(NASA-CR-141604)	EVALUATION OF ANOMALIES	N75-16794
OBSERVED ON FILM FROM S-190A FLIGHT SYSTEM		
CALIBRATION TEST (Technicolor Graphic		
Services, Inc.) 18 p HC \$3.25	CSCL 14E	Unclas
	G3/35	09918

Photographic Technology Division
National Aeronautics and Space Administration
Manned Spacecraft Center
Houston, Texas



Technicolor Graphic Services, Inc.

EVALUATION OF ANOMALIES OBSERVED ON FILM FROM S-190A
FLIGHT SYSTEM CALIBRATION TEST


This report has been reviewed
and is approved.

SUBMITTED BY:


Paul F. Bourque, Photoscientist


Lincoln Perry, Photoscientist

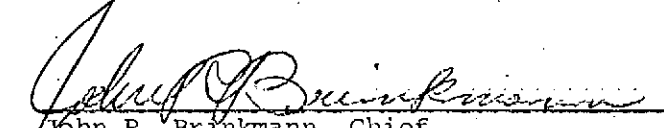
APPROVED:


Gerard E. Sauer, Supervisor
Photo Science Office

APPROVED:


Noel T. Lamar, Technical Monitor

CONCURRENCE BY:


John R. Brinkmann, Chief
Photographic Technology Division

INTRODUCTION

Due to a persistent problem of scratched film from testing of the Skylab S-190A system, a series of tests were designed to identify the cause of the film scratching. These tests were designed jointly by Mr. B. H. Mollberg, Experiment Development Manager (S-190A) and personnel of the MSC/PTD utilizing the film packaged for the S-190A camera calibration tests.

This report documents the procedures followed in this test for pretest handling and packaging of the film, the makeup of the rolls for processing, and the results of the processed film evaluation.

PRETEST FILM HANDLING PROCEDURES

At the request of the S-190A Program Office, the following rolls of film were prepared for a S-190A Flight System Calibration Test at Kennedy Space Center:

<u>Film Type</u>	<u>Quantity</u>
SO-022	4 rolls
2443	2 rolls
SO-356	2 rolls
2424	4 rolls

The preparation procedures followed were those dictated in the S-190A Project Document entitled "Film Handling Procedures for Skylab S-190A, S-190B and S-191 Experiments" (Document No. JLL2-202 attached).

Following preparation of these rolls, a single roll of each film type was selected at random to be maintained as a test control roll for each particular film type. This selection was made by Mr. B. H. Mollberg, Experiment Development Manager (S-190A), from the package of film prepared for shipment to KSC by Quality and Assurance. These rolls were then returned to the PTD Photo Science Office.

Upon receipt of the control rolls, a two-foot section of each roll was removed and tray processed; the remainder of each roll was reserved for processing with those rolls which would be used for the test at KSC. This two-foot section was removed at a distance of 14 feet from the head end of the roll. This ensured that this section had not previously been handled during roll makeup.

PREPROCESSING HANDLING AT PTD

Six rolls of S-190A test film were received from KSC on 18 January 1973 for processing at the PTD laboratory. All rolls were handled as original flight film, according to procedures established in Document J112-202, "Film Handling Procedures for Skylab S-190A, S-190B and S-191 Experiments" with the following exceptions:

1. Two feet of film was cut from the tail of each roll and sensitometry applied with the PTD I-B sensitometer. This section of film was then tray processed. Tray processing is one of the gentlest processing methods available, since no mechanical devices are employed, and the emulsion surface remains untouched throughout the processing cycle. This procedure provides a sensitive test for scratches.
2. An additional two feet was cut from the tail of each roll for a reverse-splice scratch test. In this test, a section of film is cut out, reversed end for end, and then spliced back into the roll. In this way, processing scratches can be distinguished from camera scratches. Processing scratches will continue unchanged across the splice, whereas camera scratches will show a lateral displacement due to the reversing of the film at the splice.

The physical makeup of each roll for processing is shown in Figures 1, 2, 3, and 4. These figures also include the processing machines and configurations. The process was certified in accordance with Document J112-202.

All process machine scratch tests utilized include a reverse-spliced section to test for processor caused scratches. It should also be noted that these tests involve four different film types each of which requires a different processor.

FIGURE 1

FILM TYPE 2424

CAMERA STATIONS 1 and 2

Processor: Hi-Speed

Chemistry: D-19

Temperature: 68°F.

Speed: 4 feet per minute

Two rolls of camera test film plus the one blank roll retained at PTD were spliced together in the configuration below:

LEADER	SCRATCH TEST	CONTROL STRIPS	TEST ROLL STATION #1	SCRATCH TEST STATION #1	BLANK ROLL (Test Control)	TEST ROLL STATION #2	SCRATCH TEST STATION #2	CONTROL STRIPS	SCRATCH TEST	LEADER
--------	-----------------	-------------------	-------------------------------	----------------------------	------------------------------------	-------------------------------	----------------------------	-------------------	-----------------	--------

All scratch tests were reverse-spliced.

FIGURE 2
TYPE 2443 FILM

CAMERA STATION 3

Processor: Kodak Versamat 1811 Chemistry: EA-5 Temperature: 104.5°F. Speed: 5.5 feet per minute

One roll of camera test film plus the blank roll retained at PTD were spliced together in the configuration below:

LEADER	SCRATCH TEST	CONTROL STRIPS	TEST ROLL STATION #3	SCRATCH TEST STATION # 3	BLANK ROLL (Test Control)	CONTROL STRIPS	SCRATCH TEST	LEADER
--------	-----------------	-------------------	--------------------------------	-----------------------------	------------------------------------	-------------------	-----------------	--------

All scratch tests were reverse-spliced.

FIGURE 3

FILM TYPE SO-356

CAMERA STATION 4

Processor: Houston

Chemistry: ME-4

Temperature: 98°F.

Speed: 15 feet per minute

One roll of camera test film plus the blank roll retained at PTD were spliced together in the configuration below:

LEADER	SCRATCH TEST	CONTROL STRIPS	TEST ROLL STATION # 4	SCRATCH TEST STATION # 4	BLANK ROLL (Test Control)	CONTROL STRIPS	SCRATCH TEST	LEADER
--------	-----------------	-------------------	------------------------------------	-----------------------------	---	-------------------	-----------------	--------

All scratch tests were reverse-spliced.

FIGURE 4

FILM TYPE SO-022

CAMERA STATIONS 5 and 6

Processor: Fultron

Chemistry: MX-819

Temperature: 82°F.

Speed: 10 feet per minute

Two rolls of camera test film plus the blank roll retained at PTD were spliced together in the configuration below:

LEADER	SCRATCH TEST	CONTROL STRIPS	TEST ROLL STATION # 5	SCRATCH TEST STATION # 5	BLANK ROLL (Test Control	TEST ROLL STATION # 6	SCRATCH TEST STATION # 6	CONTROL STRIPS	SCRATCH TEST	LEADER
--------	--------------	----------------	--------------------------	--------------------------	-----------------------------	--------------------------	--------------------------	----------------	--------------	--------

All scratch tests were reverse-spliced.

RESULTS

After processing each roll of film, the roll was removed from the machine and taken to the PTD Precision Processing Laboratory film inspection area for evaluation. The film evaluation team consisted of PTD personnel and Mr. B. H. Mollberg. The Precision Laboratory Film Inspection Report for each roll is included as Appendix A of this report. Results of the film evaluation are:

Film Type 2424

- Leader and Machine Scratch Tests - no anomalies
- Control Strips - no anomalies (some handling marks)
- Test Roll Station #1 - significant anomalies (see Film Inspection Report, Appendix A)
- Test Control Roll - minor anomalies (see Film Inspection Report, Appendix A)
- Test Roll Station #2 - significant anomalies (see Film Inspection Report, Appendix A)

Tray-Processed Sections:

- Test Roll Station #1 - anomalies similar to those reported in Film Inspection Report
- Test Roll Station #2 - anomalies similar to those reported in Film Inspection Report
- Test Control Roll - minor edge fogging, no scratches

Film Type 2443

- Leader and Machine Scratch Tests - no anomalies.
- Control Strips - no anomalies (some handling marks)
- Test Roll Station #3 - significant anomalies (see Film Inspection Report, Appendix A)
- Test Control Roll - no anomalies

Tray-Processed Sections:

Test Roll Station #3 - anomalies similar to those reported in
Film Inspection Report

Test Control Roll - no anomalies

Film Type SO-356:

Leader and Machine Scratch Tests - no anomalies

Control Strips - no anomalies (some handling marks)

Test Roll Station #4 - significant anomalies (see Film
Inspection Report, Appendix A)

Test Control Roll - no anomalies

Tray-Processed Sections:

Test Roll Station #4 - anomalies similar to those reported
in Film Inspection Report

Test Control Roll - no anomalies

Film Type SO-022

Leader and Machine Scratch Tests - no anomalies

Control Strips - no anomalies (some handling marks)

Test Roll Station #5 - significant anomalies (see Film
Inspection Report, Appendix A)

Test Control Roll - no anomalies

Test Roll Station #6 - significant anomalies (see Film
Inspection Report, Appendix A)

Tray-Processed Sections:

Test Roll Station #5 - anomalies similar to those reported
in Film Inspection Report

Test Roll Station #6 - anomalies similar to those reported
in Film Inspection Report

Test Control Roll - no anomalies

A significant number of scratch anomalies from this test were found to be geometrically correlated with scratches which were observed on the film from the scratch tests run on the Skylab S-190A System in mid-December 1972. This correlation was on a station-by-station basis.

Scratches were also found to be laterally offset at the splices for the reversed sections from the various test rolls.

CONCLUSIONS

As a result of these tests, it is concluded that the film scratches observed are not caused by the processing. This conclusion is supported by the following facts.

1. Lack of any observed scratches on machine scratch tests, control strips and test control rolls.
2. Lateral offset of scratch marks at the reverse-spliced sections.
3. Geometric correlation of scratches from December 1972 scratch tests (December test used SO-022 film on all six camera stations; processed in Fultron)
4. Similar anomalies observed on test rolls which were processed utilizing four different processors.

The condition of the test control rolls after processing shows that the film handling and loading procedures established at PTD (Document No. JLL2-202) ensure the quality of the film supplied by PTD to Quality and Assurance for transmittal to KSC. This test also verifies that the film supplied by Kodak contains no unexplained anomalies. The minor edge fog reported for film type 2424 is caused in the slitting operation in Kodak's Film Finishing. This edge fog is unavoidable in this product due to the pressure sensitivity of the emulsion and is generally restricted to non-image frame areas of the film.

This test has eliminated the following as possible sources of the anomalies observed:

1. Raw film stock
2. PTD pre-test loading and handling procedures
3. PTD post-test processing and handling procedures.

PRECISION LAB

DATE 1-20-73

ORIGINAL FLIGHT FILM EVALUATION

MISSION SKYLAB		ROLL NUMBER STATION 1 & 2	FILM TYPE & BATCH # 2424	SITE(S) TEST	FLIGHT(S) TEST
SENSOR S-190A	FILTER(S) n/a	LENGTH	DATE FLOWN n/a	EXPOSURES n/a TO	AIRCRAFT n/a
FRAME OVERLAP n/a		SNOW/CLOUD COVERAGE n/a		DATA CHAMBER Exposure n/a	Status
IMAGE EXPOSURE: n/a					POST SENSITOMETRY YES

IMAGE & PHYSICAL DEFECTS

DEFECT CODE

- * Processing roll makeup accomplished in accordance with PSO diagram.
- Station 1 (Exposed):
 - Emulsion scratches (light to med plus and minus density) throughout roll
 - Heavy abrasions last two exposures.
 - Minus density mottle in exposed areas
 - Heavy fog following exposed frames 15-20'.
 - Dust on Reseau plate
 - Handling marks in all splice and sensitometry areas
 - Both edges fogged.
 - 2424 Blank and Processing Controls
 - Both edges fogged
 - No scratches, chemical streaks, pressure marks, processor or processing anomalies
 - Station 2 (Exposed):
 - Same remarks as Station 1 (Exposed) a through g.

DEFECT CODES:

- | | | | |
|-------------------------|-------------------------|-------------------------|--------------------|
| (1) Abrasions | (7) Density Marks/Plus | (13) Pin Holes | (19) Water Spots |
| (2) Banding | (8) Drying Marks | (14) Rawstock Defects | (20) Other Defects |
| (3) Camera Malfunctions | (9) Finger Prints/Glove | (15) Roller Marks | |
| (4) Chemical Stains | (10) Fog | (16) Scratches/Base | |
| (5) Dirt | (11) Folds/Wrinkles | (17) Scratches/Emulsion | |
| (6) Density Marks/Minus | (12) Hot Spots/Spectral | (18) Static | |

REMARKS Above defects and comments verified by B. Mollberg on 1/20/73.

PROCESSING DATA

J. Pickerson

PROCESSOR Hi-Speed	HEAD	TAIL	CHEMISTRY D-19	TEMP 68°	SPEED 4 fpm	DATE PROCESSED 1-19-73	OPERATOR Williams
-----------------------	------	------	-------------------	-------------	----------------	---------------------------	----------------------

PRECISION LAB

DATE 1-20-73

ORIGINAL FLIGHT FILM EVALUATION

MISSION SKYLAB		ROLL NUMBER STATION 3		FILM TYPE & BATCH # 2443		SITE(S) TEST		FLIGHT(S) TEST	
SENSOR S190A		FILTER(S) n/a		LENGTH 220'		DATE FLOWN n/a		EXPOSURES n/a TO n/a	
FRAME OVERLAP n/a		SNOW/CLOUD COVERAGE n/a				DATA CHAMBER Exposure n/a		Status	
IMAGE EXPOSURE: n/a								POST SENSITOMETRY YES	

IMAGE & PHYSICAL DEFECTS

DEFECT CODE

* Processing roll makeup was accomplished in accordance with PSO diagram.

1. Station 3 (exposed):

- a. Emulsion scratches, continuous (med-severe plus & minus density) 1/8 to 1/4" apart.
- b. Base scratches, continuous (light-med) 1/8 to 1/4" apart.
- c. Pinholes, scattered throughout roll.
- d. Image area, plus density pressure marks and Newton rings throughout roll.
- e. Handling marks in all splice and sensitometry areas.

2. 2443 (Blank) and Processing Controls:

- a. No scratches, chemical streaks, pressure marks, processor or processing anomalies.
- Total 7 pinholes in entire blank roll.

DEFECT CODES:

- | | | | |
|-------------------------|-------------------------|-------------------------|--------------------|
| (1) Abrasions | (7) Density Marks/Plus | (13) Pin Holes | (19) Water Spots |
| (2) Banding | (8) Drying Marks | (14) Rawstock Defects | (20) Other Defects |
| (3) Camera Malfunctions | (9) Finger Prints/Glove | (15) Roller Marks | |
| (4) Chemical Stains | (10) Fog | (16) Scratches/Base | |
| (5) Dirt | (11) Folds/Wrinkles | (17) Scratches/Emulsion | |
| (6) Density Marks/Minus | (12) Hot Spots/Spectral | (18) Static | |

REMARKS Above defects and comments verified by B. Mollberg on 1/20/73.

PROCESSING DATA

PROCESSOR 1811 #2	HEAD	TAIL	CHEMISTRY EA-5	TEMP 104.5	SPEED 5.5	DATE PROCESSED 1/19/73	OPERATOR Matysiak/Wissman
----------------------	------	------	-------------------	---------------	--------------	---------------------------	------------------------------

PRECISION LAB

DATE 1-20-73

ORIGINAL FLIGHT FILM EVALUATION

MISSION SKYLAB		ROLL NUMBER STATION 4	FILM TYPE & BATCH # SO-356	SITE(S) TEST	FLIGHT(S) TEST
SENSOR S-190A	FILTER(S) n/a	LENGTH n/a	DATE FLOWN n/a	EXPOSURES n/a TO	AIRCRAFT n/a
FRAME OVERLAP n/a		SNOW/CLOUD COVERAGE n/a		DATA CHAMBER Exposure n/a Status	
IMAGE EXPOSURE: n/a					POST SENSITOMETRY YES

IMAGE & PHYSICAL DEFECTS

DEFECT CODE

* Processing roll makeup was accomplished in accordance with PSO diagram.

1. Station 4 (exposed):

- a. Emulsion scratches (light) throughout roll.
- b. Base scratches (light) throughout roll.
- c. Dirt on Reseau plate
- d. Newton rings in image areas
- e. Mild mottling in exposed area
- f. Handling marks in all splice and sensitometry areas.

2. SO-356 Blank and Processing Controls

- a. No scratches, chemical streaks, pressure marks, processor or processing anomalies.

DEFECT CODES:

- | | | | |
|-------------------------|-------------------------|-------------------------|--------------------|
| (1) Abrasions | (7) Density Marks/Plus | (13) Pin Holes | (19) Water Spots |
| (2) Banding | (8) Drying Marks | (14) Rawstock Defects | (20) Other Defects |
| (3) Camera Malfunctions | (9) Finger Prints/Glove | (15) Roller Marks | |
| (4) Chemical Stains | (10) Fog | (16) Scratches/Base | |
| (5) Dirt | (11) Folds/Wrinkles | (17) Scratches/Emulsion | |
| (6) Density Marks/Minus | (12) Hot Spots/Spectral | (18) Static | |

REMARKS

Above defects and comments verified by B. Mollberg on 1/20/73.

PROCESSING DATA

PROCESSOR HOUSTON	HEAD	TAIL	CHEMISTRY ME-4	TEMP 98°	SPEED 15 fpm	DATE PROCESSED 1-20-73	OPERATOR MAYES
----------------------	------	------	-------------------	-------------	-----------------	---------------------------	-------------------

PRECISION LAB

DATE 1-20-73

ORIGINAL FLIGHT FILM EVALUATION

MISSION SKYLAB		ROLL NUMBER STATION 5 & 6	FILM TYPE & BATCH # SO-022	SITE(S) Test	FLIGHT(S) Test
SENSOR S-190A	FILTER(S) n/a	LENGTH	DATE FLOWN n/a	EXPOSURES n/a TO	AIRCRAFT n/a
FRAME OVERLAP n/a		SNOW/CLOUD COVERAGE n/a		DATA CHAMBER Exposure n/a	Status
IMAGE EXPOSURE: n/a					POST SENSITOMETRY YES

IMAGE & PHYSICAL DEFECTS

DEFECT CODE

- * Processing roll makeup was accomplished in accordance with PSO diagram.

1. Station 5 (Exposed):

- a. Emulsion scratches (severe plus density) throughout entire roll
- b. Base scratches (light-med) throughout entire roll
- c. Image area severe plus and minus density scratches
- d. Aft lens element flare
- e. Dust on Reseau plate
- f. Heavy fog bands following imagery
- g. Reverse scratch 2' indicates correlation
- h. Handling marks in all splice and sensitometry areas.

2. SO-022 Blank and Processing Controls

- a. No processing/processor anomalies noted. Exceptionally "clean".

3. Station 6 (Exposed):

- a. Same Comment as Station 5 (a through h).

Wide plus density pressure mark throughout roll.

- DEFECT CODES:
- | | | | |
|-------------------------|-------------------------|-------------------------|--------------------|
| (1) Abrasions | (7) Density Marks/Plus | (13) Pin Holes | (19) Water Spots |
| (2) Banding | (8) Drying Marks | (14) Rawstock Defects | (20) Other Defects |
| (3) Camera Malfunctions | (9) Finger Prints/Glove | (15) Roller Marks | |
| (4) Chemical Stains | (10) Fog | (16) Scratches/Base | |
| (5) Dirt | (11) Folds/Wrinkles | (17) Scratches/Emulsion | |
| (6) Density Marks/Minus | (12) Hot Spots/Spectral | (18) Static | |

REMARKS Above defects and comments verified by B. Mollberg on 1/20/73.

PROCESSING DATA

J. Mickerson

PROCESSOR FULTRON #2	HEAD	TAIL	CHEMISTRY MX-819	TEMP 82°	SPEED 10 fpm	DATE PROCESSED 1-19/1-20-73	OPERATOR Crane
-------------------------	------	------	---------------------	-------------	-----------------	--------------------------------	-------------------